Data Structure in Java

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Introduction

In Java, there are several commonly used data structures available in the standard library that provide efficient ways to store and manipulate collections of elements. These data structures include ArrayList, HashSet, HashMap, Stack, Queue, and PriorityQueue. Each data structure is designed for specific use cases and offers different features and behaviors.

Data structures in java

data structures are used to organize and store data efficiently and provide methods for accessing, manipulating, and managing that data. Java provides a rich set of built-in data structures through its standard library, as well as the ability to create custom data structures

1- **ArrayList**
are resizable arrays. Unlike built-in arrays that have a fixed size, ArrayLists can dynamically adjust their size. This flexibility allows for the addition and removal of elements as needed, providing users with convenient memory management capabilities.

Uses: commonly used when you need a resizable array-like structure that provides constant-time access to elements. They are useful when the size of the collection may vary, and you need to perform operations like adding, removing, or accessing elements efficiently.

Methods:
- add(element): Adds an element to the end of the ArrayList.
- get(index): Retrieves the element at the specified index.
- remove(index): Removes the element at the specified index.
- size(): Returns the number of elements in the ArrayList.
- contains(element): Checks if the ArrayList contains a specific element.

2- HashSet
is an implementation of the Set interface in Java that uses a hash table to store unique elements.

Uses: HashSet is useful when you need to store a collection of elements without duplicates. It offers constant-time performance for essential operations like adding, removing, and checking element existence.

Methods:
- add(element): Adds an element to the HashSet.
- remove(element): Removes the specified element from the HashSet.
- contains(element): Checks if the HashSet contains a specific element.
- size(): Returns the number of elements in the HashSet.
- isEmpty(): Checks if the HashSet is empty.

3- **HashMap**

HashMap is an implementation of the Map interface in Java that stores key-value pairs using a hash table.

Uses: HashMap is employed when you need to store and retrieve values based on unique keys. It provides fast access to values using keys, making it useful for scenarios where quick lookup is required.

Methods:

- put(key, value): Associates the specified value with the specified key in the HashMap.
- get(key): Retrieves the value associated with the specified key.
- remove(key): Removes the entry with the specified key from the HashMap.
- containsKey(key): Checks if the HashMap contains a specific key.
- keySet(): Returns a Set containing all the keys in the HashMap.

4- **Stack**

is a data structure that follows the Last-In-First-Out (LIFO) principle. It provides operations to push elements onto the stack and pop elements from the top.

Uses: Stack is used when you need to maintain a collection of elements in a specific order, such as undo/redo operations, parentheses matching, or depth-first search algorithms.

Methods:

- push(element): Pushes an element onto the top of the stack.
- pop(): Removes and returns the element at the top of the stack.
- peek(): Returns the element at the top of the stack without removing it.
- isEmpty(): Checks if the stack is empty.
- search(element): Searches for the specified element in the stack and returns its position.

5- **Queue**

is a data structure that follows the First-In-First-Out (FIFO) principle. It provides operations to add elements to the end of the queue and remove elements from the front.

Uses: Queue is used when you need to process elements in the order of their arrival, such as task scheduling, message passing, or breadth-first search algorithms.

Methods:

- add(element): Adds an element to the end of the queue.
- remove(): Removes and returns the element at the front of the queue.
- peek(): Returns the element at the front of the queue without removing it.
- isEmpty(): Checks if the queue is empty.
- size(): Returns the number of elements in the queue.

6- **PriorityQueue**
is an implementation of the Queue interface in Java that orders elements based on their priority.

Uses: used when you need to process elements based on their priority. Elements with higher priority are dequeued first.

Methods:

- add(element): Adds an element to the priority queue based on its priority.
- remove(): Removes and returns the element with the highest priority.
- peek(): Returns the element with the highest priority without removing it.
- isEmpty(): Checks if the priority queue is empty.
- size(): Returns the number of elements in the priority queue.

Conclusion

Choosing the right data structure in Java is crucial for efficient and effective programming. By understanding the characteristics and capabilities of different data structures like ArrayList, HashSet, HashMap, Stack, Queue, and PriorityQueue, you can select the most appropriate one based on your specific requirements. Whether you need a resizable array, a collection without duplicates, a key-value mapping, or specific order-based processing, Java provides a range of data structures to facilitate your programming needs.

Reference

1- **https://www.educative.io/answers/what-is-an-arraylist-in-java**
2- **https://www.simplilearn.com/tutorials/java-tutorial/hashset-in-java**
3- **https://java-programming.mooc.fi/part-8/2-hash-map**
4- **https://www.geeksforgeeks.org/queue-interface-java/**
5- **https://www.geeksforgeeks.org/priority-queue-class-in-java/**